6341-UM-152

INSTRUCTION MANUAL

for

SERVOCORDER

model SR6341/6342

WESTERN GRAPHTEC

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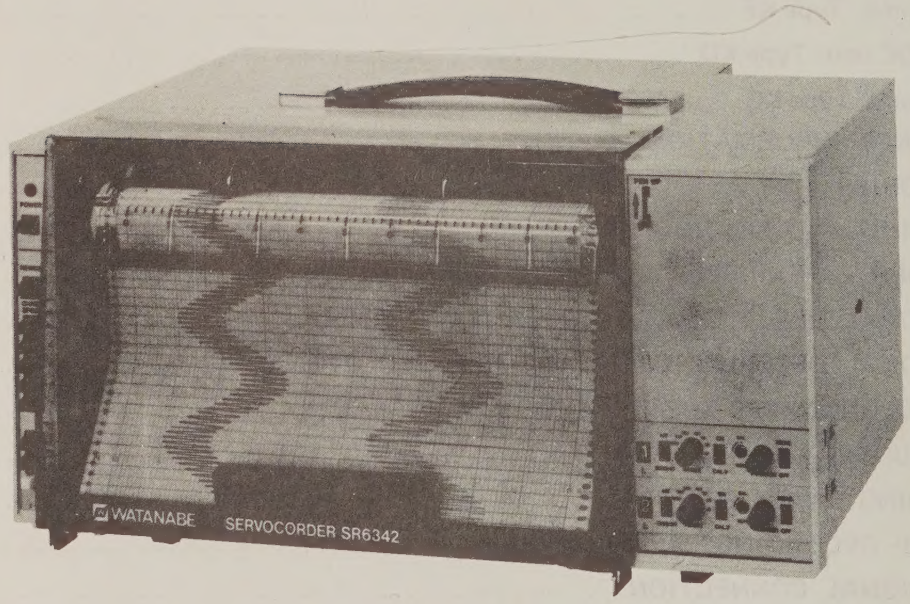
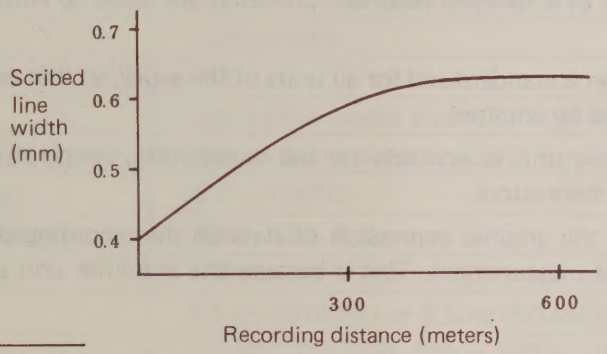

WATANABE
SERVOCORDER SR6342

Basic Information for the User of SR6341/6342 SERVOCORDER

About the disposable fiber pen

This is a high-performance recording pen specially developed for the SR6341/6342 SERVOCORDER.

- It is a disposable pen. In normal use, it can be used for about 600 meters of recording distance.
- Before placing the servocorder in a long outage, remove the pen, put the cap on it and keep it in a box.
- Avoid shocks to the pen nib; do not press the pen forcibly against a hard surface. The nib is delicate and must be protected against chances of distortion. Keep up its high scribing performance by taking good care of it.
- The width of the line that the pen scribes will increase with continued usage. Here's its life characteristic:



About folded recording paper

- Under high humidity condition, the self-folding property of the paper might deteriorate. Avoid relative humidity exceeding 85%.
- Re-use of recorded paper is not recommendable, although the self-folding property of the paper does not deteriorate in the first or even second recording. However, re-using it many times is sure to result in paper fouling.
- Bear in mind that the paper emerging from the Servocorder may appear moist if high-density recording has been effected.
- The recording paper is an important factor of the Servocorder's performance. Use the paper bearing the check stamping of the manufacturer.

About the amplifier unit

- Part of the main recorder unit must be remodeled to enable the use of a Type E and Temperature unit.
- The specifications and control panel of the main recorder unit will be partly modified when any of the options F-205 (event marker), F-206 (time marker) or F-219 (remote pen lift) is incorporated.

1. GENERAL DESCRIPTION

One of the SR6341/6342 SERVOCORDERS which have evolved from years of manufacture of servo-drive pen recorders and designed anew with new features, this recorder is characterized as follows:

- O Main electrical circuits are implemented by high-grade ICs: the recorder is built compact and light in weight.
- O Direct-coupled servo drive with a high-torque DC motor and a conductive plastic potentiometer ensures the low-drift, fast-response and high-precision pen movement.
- O The recorder paper is transported with a precision-controlled speed selected and set as desired: the drive is by a step motor controlled by a 1-chip microcomputer.
- O Two types of recording paper can be used: roll paper and folded paper. Both types permit winding-back. The user can depend on the manufacturer for supply of recording paper.
- O The data signal is received through a guarded, floating-ground input circuit for each signal channel. In the case of a two-pen recorder, provision are made to eliminate cross-talk interference.
- O The connector design is standardized for all units of the series, so that each unit in service can be readily supplanted by another.
- O A special temperature unit is available for use in recording temperature data originating in thermocouples and thermistors.
- O Variety is given to the graphic expression of data on the recording chart paper for a wide range of purposes of measurement. This is because the amplifier unit is selective (Log, F/V, AC/DC).

2. RECORDER PROPER SPECIFICATIONS

Type designation :	SR6341/6342 SERVOCORDER
Number of channels :	1 or 2
Circuitry :	DC servo type (isolation amplifier)
Recording pen :	Fiber pen (usable for up to about 600 meters of recording distance)
Effective scribing amplitude :	250 mm full scale for each channel
Recording chart paper :	Folded paper (15 meters long) and roll paper(20 meters long)
Chart feed system :	Stepper motor driven
Chart speed :	7.5, 15, 30, 60 and 120 mm/min or mm/hour, EXT (0.05 mm/pulse)
(Option)	20, 50, 100, 200 and 500 mm/min or mm/hour, EXT (0.05 mm/pulse)
Accuracy : (standard range , 1V)	±0.25% of full scale (Including linearity and dead zone)
Max. pen speed :	1000 mm/sec
Max. acceleration :	2 G
Potentiometer :	Conductive plastic potentiometer (C.P.P.)
Pen lifting :	Manual lifting simultaneously for all channels
Ambient temp. range :	0°C ~ +45°C
Ambient humidity range :	30% ~ 85% R.H.
External dimensions :	438 mm(W) x 240 mm(D) x 199 mm(H)
Weight :	8.5 kg (SR**6341**) or 9.5 kg (SR**6342**)
Power requirement :	AC 100, 115, 200, 220 or 240 V ±10%
Power consumption :	25 VA max. and 18 VA average for 1-pen recorder (SR6321)
	50 VA max. and 25 VA average for 2-pen recorder (SR6322).

When any of the options F-205, F-206 and F-219 is incorporated, the specifications of the recorder will be changed as shown below.

Item \ Type	SR6341/6342
Chart speed :	7.5, 15, 30, 60, 75, 120, 150, 300, 600, 1200 mm/min or mm/hour, EXT (0.05 mm/pulse)
	Option: D-203D 20, 30, 40, 50, 60, 200, 300, 400, 500, 600 mm/min or mm/hour, EXT (0.05 mm/pulse)
Max. pen speed :	1,600 mm/sec
Max. acceleration :	3G (29,400 mm/sec)
External dimensions :	438(W) x 260(D) x 249(H) mm
Weight	12 Kg (SR6341), 13 Kg (SR6342) approximately

3. AMPLIFIER UNIT SPECIFICATIONS

(1) Voltage unit

Item \ Type	E	H	Z	L
Maximum sensitivity	0.1 mV/250 mm	1 mV/250 mm	1 mV/250 mm	10 mV/250 mm
Measuring ranges (Switching accuracy)	0.1; 0.2; 0.5; 1; 2; 5; 10; 20; 50 (±0.15%)	1; 2; 5; 10; 20; 50; 100; 200; 500 (±0.15%)	1; 2; 5; 10; 20; 50; 100; 200; 500 (±0.15%)	10; 20; 50; 100; 200; 500; 1000 (±0.3%)
Multiplier (Switching accuracy)	mV; V (±0.1%)	mV; V (±0.1%)	mV; V (±0.1%)	mV; x 100 mV (±0.15%)
Input resistance	1 MΩ constant	10 MΩ/mV range 20 MΩ/V range		1 MΩ constant
Allowable signal source resistance	1 kΩ max.	10 kΩ max.		1 kΩ max.
Sensitivity adjustment	Continuously adjustable between ranges			
Calibrating voltage	1/2 of full scale			
Zero set	130% min. of full scale		Continuously variable between −300% and +300% of full scale	130% min. of full scale
Zero suppression				
Characteristic of input filter		ON: −40 dB min. OFF: 50 Hz −2.8 dB 60 Hz −3.5 dB		50 Hz −10 dB 60 Hz −11 dB
Common mode rejection ratio	AC 130 dB DC 150 dB			
Max. input voltage	DC 500 V			

(2) Log unit: Type KL

Item \ Input (AC or DC)		DC	AC
Input suppression range		60 dB	60 dB (0 ~ 20 KHz)
Measuring ranges		0.5 V position: 0.5 mV ~ 0.5 V 5 V position: 5 mV ~ 5 V 50 V position: 50 mV ~ 50 V 500 V position: 500 mV ~ 500 V	0.5 V position: 0.5 mV ~ 0.5 V 5 V position: 5 mV ~ 5 V 50 V position: 50 mV ~ 50 V 500 V position: 500 mV ~ 500 V (rms)
Accuracy	Sensitivity	Within ±0.25 dB	
	Linearity	Within ±0.5 dB	Within ±1.0 dB
	Drift	0.3 dB/12 Hr, 0.3 dB/10°C	
Response time		Rise 0.1 sec/20 dB Fall 1 sec/40 dB Fall 3 sec/60 dB	0.1 sec/20 dB (100 Hz and over)
Range of operating frequency		DC	10 Hz ~ 20 KHz (±1 dB)
Zero set		±10% of full scale (±6 dB)	

(3) F-V unit: Type KF

Frequency measuring range	20, 50, 100, 200, 500 Hz 1, 2, 5, 10 KHz/F.S. 9 ranges selective by switching
Input voltage range	0.5 ~ 200 V (P-P)
Input resistance	100 kΩ constant
Linearity	±0.5% of full scale
Ripple	1.5% (for 20 Hz)
Response time	0.6 second for full scale
Accuracy	±0.5% of full scale
Zero set	50% of full scale

(4) AC-DC unit: Type KD

Frequency range	10 Hz ~ 100 KHz (±1 dB)
Linearity	±0.5%
Measuring ranges	10, 20, 50, 100, 200, 500 mV 1, 2, 5, 10, 20, 50, 100, 200 V (14 ranges selective by switching and selecting multiplying factor)
Input resistance	1 MΩ 10PF
Response time	0.2 sec
Residual ripple	0.5% max.
Allowable supply voltage variation	±0.5% max.
Type of rectification	Effective value rectification
Drift	0.03%/°C
Position adjustment	120% of full scale

In the case of KD-3, the measuring ranges are specified as follows:

10; 20; 50; 100; 200; 500 mV
1; 2; 3; 5; 10; 20; 50; 100; 300 V
(15 selective ranges, including multiplier)

(5) DC unit: Type KC

Type of input	Direct current
Maximum sensitivity	10 mA/250 mm
Measuring ranges (/full scale)	0 ~ 10 mA/full scale 0 ~ 20 mA/full scale 4 ~ 20 mA/full scale
Input resistance	10 Ω
Calibration standard	
Zero set	Between +30% and −10% of the full scale
Linearity	±0.5%
Drift	0.5%/10°C
Ripple	
Response time (TYP)	0.2 sec (full scale)
Max. allowable input current	150 mA

4. REFERENCE INFORMATION

Preamplifier unit stability information: Types L, H, Z and E

Item \ Type		L	H	Z	E
Temperature stability	Zero point shift	0.7μV/°C TYP* 2.0μV/°C MAX			0.05μV/°C
	Sensitivity variation	0.02%/°C TYP, full scale 0.03%/°C MAX, full scale			
Stability for 10% supply voltage variation (zero point) per hour	Zero point shift	0.15% max. of full scale			
	Sensitivity variation	0.15% max. of full scale			
Long-term stability (after-turning on power supply and at 20°C ±5°C)		0.25% max. of full scale			

NOTE: * "TYP" means values occurring with probability of 50% or higher.

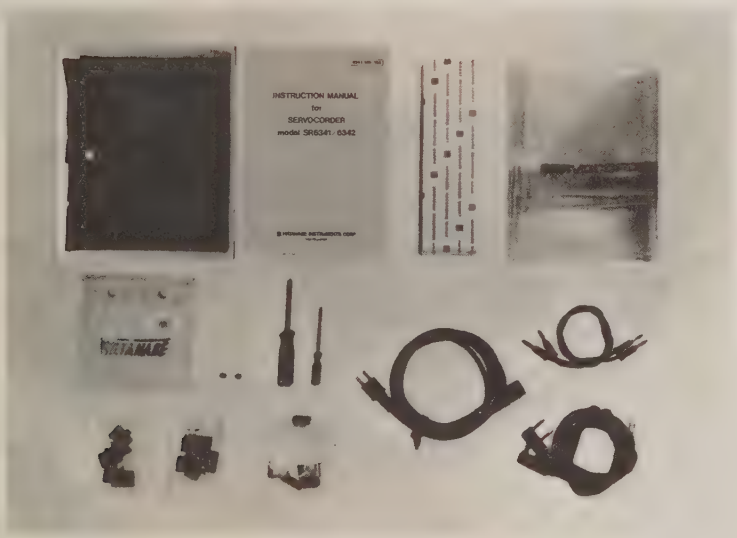
5. ACCESSORIES

SR6341, SR6342

Accessory	Qt.
Instruction manual	1 copy
Recording paper (SP242, 15 m)	1 vol.
Recording pen (KF-300), colored (KF200 when option F-205, F-206 or F-219 incorporated)	5 for each channel
Input signal cord (with 3P plug, 2 m)	1 for each channel
Vinyl cover	1
Phillips screwdriver (3 mm)	1
Plain-tip screwdriver (2 mm)	1
Fuse (2A)	1
Remote connector	1
Power supply cord	1
Cord for calibration	1

The following is included in the roll paper option :

Recording paper (SP216B, 20m)	1 roll
Stock rollers (stock, winding)	1 each



6. UNPACKING AND SETTING UP

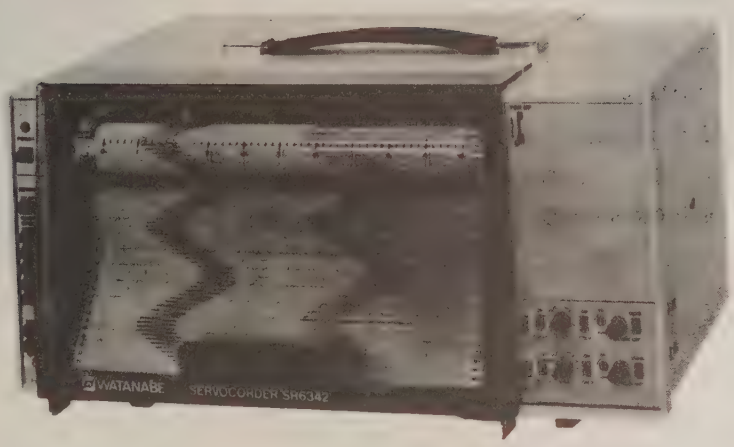
(1) Before taking out the recorder, inspect the condition of the package for any sign of damage and, if such a sign or evidence is noted, take note of it for future reference. After taking out the recorder, inspect it for visible signs of damage. Any damage or a shortage or overage of accessories discovered at this stage should be put in writing.

(2) The SR6341/6342 recorder may be placed in service on a desk top; it may be mounted on a rack. Fittings for rack mounting are available as E-212A and E-212B, both of which are optional.

The rack fittings D-212A and D-212B are used when the F-205, F-206 or F-219 option is incorporated.

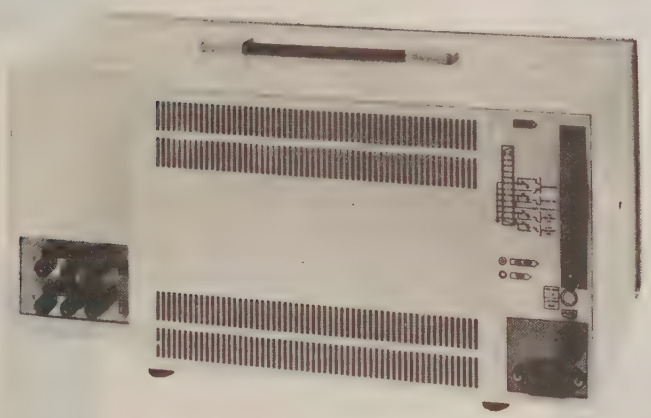
(3) Recorder stand makes pen moving easy to see when used as desk top.

7. RECORDER APPEARANCE



(a) Frontal view

Fig. 1



(b) Rear view

Fig. 2

8. FUNCTIONAL DESCRIPTION OF OPERATION PANEL

POWER

This is a push-to-turn-on and push-to-turn-off switch. When it is ON, the pilot lamp above the button remains on.

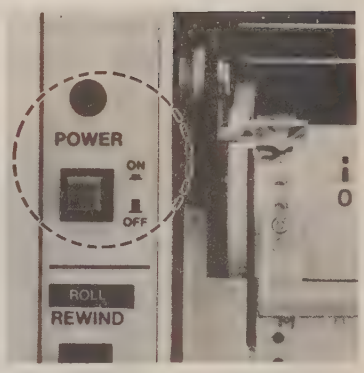


Fig. 3

ROLL REWIND (optional)

To rewind the recording paper, press this button. The paper will be wound back as long as the button is kept pressed down: releasing the button stops the rewinding action. REWIND switch is independent of other switches related to paper transport, and is not affected by any remote signal.

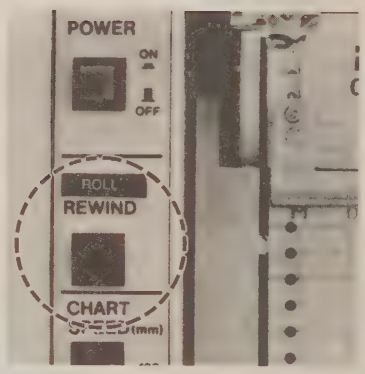


Fig. 4

CHART SPEED

These buttons serve as means of setting the chart speed in combinations with RATE OF SPEED. Five selections are provided.

* When none of the buttons is down, paper will be fed at the maximum speed.

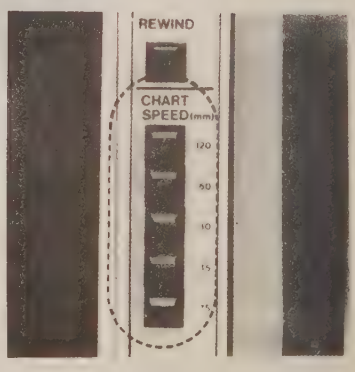


Fig. 5

RATE OF SPEED

This switch is for selecting paper transport mode.

MIN-HOUR : transport pen minutes
: transport pen hour

START-STOP : transport start.
: transport stop.

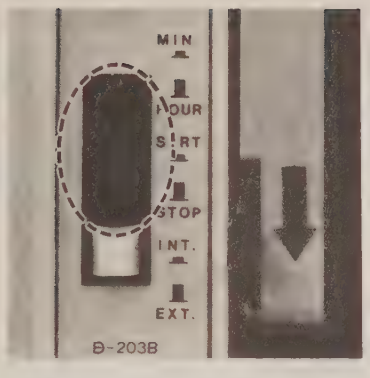


Fig. 6

INT-EXT

This switch is for selecting between external (remote) control and internal control of paper transport.

: INT
: EXT

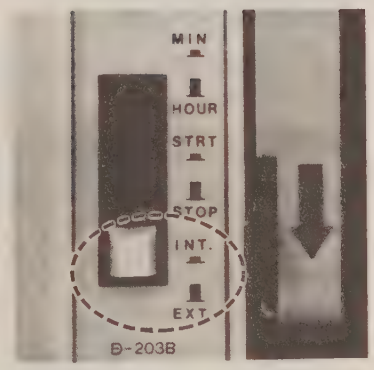


Fig. 7

GRADUATED RULE

Serves as a ruler for the oscillation of the pen. When setting the recording paper, this is moved in order to hold the paper steady.

Fig. 8

The control panel when the F-205, F-206 or F-219 option is incorporated.

PEN LIFT

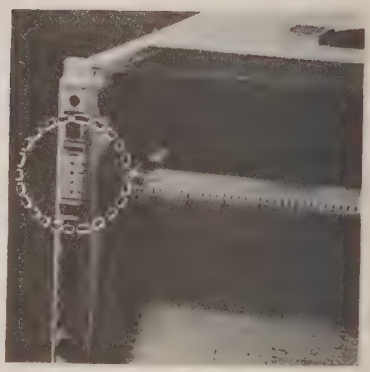
This lever lifts the pens off the recording paper. Move the lever upwards to raise the pens.

Fig. 9

TIMING

This indicates the timing at which the time marker operates when the recording paper is being fed.

The timing is automatically set in accordance with the chart speed as shown below (optional).



Timing	Chart speed
1 SEC	1200, 600 mm/MIN
10 SEC	300, 150, 120, 75, 60 mm/MIN
1 MIN	30, 15 mm/MIN, 1200, 600 mm/HOUR
10 MIN	7.5 mm/MIN, 300, 150, 120, 75, 60, 30, 15, 7.5 mm/HOUR

The time marker generates double pulses to make reading easy. The double pulses are generated at the following intervals:

- When timing is 1 SEC, a double pulse every 10 second.
- When timing is 10 SEC, a double pulse every 1 minute.
- When timing is 1 MIN, a double pulse every 10 minutes.
- When timing is 10 MIN, a double pulse every 1 hour.

Double pulse

CAL OUT

This is a reference voltage available from the amplifier unit. The reference voltage (+1V) is obtained by contacting the respective terminal. (Type GND)

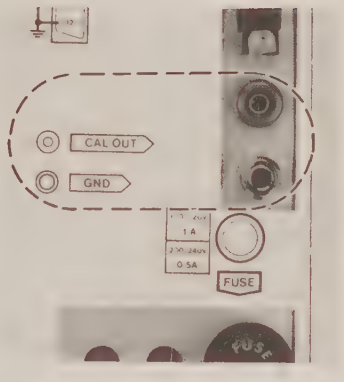


Fig. 10

REMOTE

This is a multi-pen connector for receiving control signals from external source to control paper transport, event marker (optional) and pen up/down.

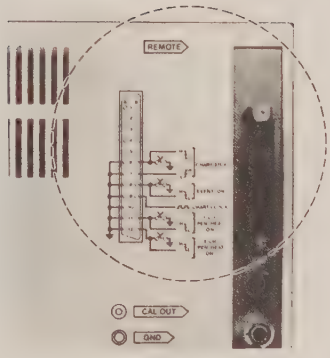


Fig. 11

GND

Plugging the grounding wire into this jack electrically grounds the chassis.

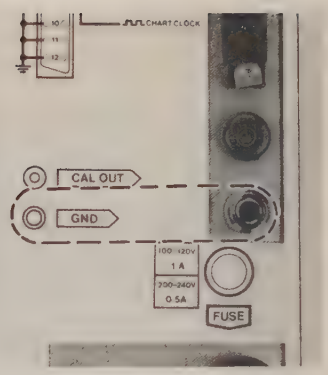


Fig. 12

INPUT TERMINALS

Input signals to be recorded come in through these terminals. (The recorder is shipped from factory with red (—) terminal connected to black terminal through a shunt, as shown.) The black one is a guard terminal not electrically connected to the chassis.

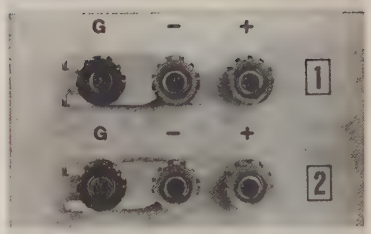


Fig. 13

9. FUNCTIONAL DESCRIPTION OF AMPLIFIER CONTROLS

(1) Type L

MEAS/OFF

Move this switch to "MEAS" position to turn on input signal: moving it to "OFF" position turns off input signal.

POSITION

This knob is for use in adjusting the pen position. The pen can be set at any point within the full scale in the absence of input.

CAL/VERNI

This knob is for amplitude adjustment. By turning it, amplitude can be changed continuously between ranges. Turning it all the way clockwise to "CAL" holds the sensitivity at the value given to the range.

CAL. V

Pressing this applies the reference voltage, which is one-half of the range. When adjusting by means of VERNI knob, use the reference voltage for the purpose of amplitude calibration.

RANGE

Input attenuation is set by means of this knob to select from 7 ranges of 10mV up to 1000mV. Selection is to be made with this knob and the selector switch (mV/x100mV): a total of 14 ranges of 10mV up to 100 volts (—100 x 100mV) are available for selection.

Type L

(2) Type H

MEAS/OFF (The same as that of Type L)

POSITION (The same as that of Type L)

CAL/VERNI (The same as that of Type L)

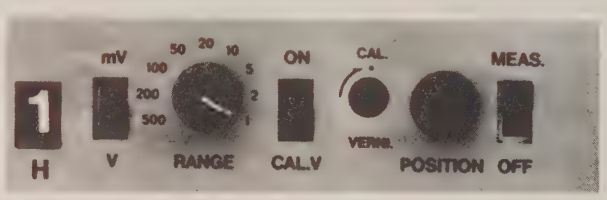
CAL.V (The same as that of Type L)

RANGE

Nine ranges are provided for selection, the lowest being 1 and the highest being 500. Actually a total of 18 ranges are available for selection because the unit switch provides two choices, mV and V.

mV/V

Moving this switch to "mV" position gives the millivolt as the unit of the selected range. Position "V" is for volts.



Type H

(3) Type Z

MEAS/OFF (The same as that of Type L)

BIAS

A bias voltage for canceling out the DC component superimposed on the measurement signal is applied by means of this knob. This voltage can be varied continuously between –300% and +300% of the range voltage.

CAL/VERNI (The same as that of Type L)

CAL. V (The same as that of Type L)

RANGE (The same as that of Type H)

mV/V (The same as that of Type H)

Type Z

(4) Type E

MEAS/OFF (The same as that of Type L)

POSITION (The same as that of Type L)

CAL/VERNI (The same as that of Type L)

CAL.V (The same as that of Type L)

RANGE

Nine ranges are provided for selection, the lowest being 0.1 and the highest being 50. Actually a total of 18 ranges are available because the unit switch (mV/V) provides two choices for the unit.

Type E

Current unit: Type KC

MEAS/OFF : (The same as that of Type L)

RANGE : 3 ranges of input current can be selected.
- o 0 ~ 10 : Measuring current range 0 ~ 10 mA
- o 0 ~ 20 : Measuring current range 0 ~ 20 mA
- o 4 ~ 20 : Measuring current range 4 mA ~ 20 mA

ZERO : For adjustment of pen position from 0 mA to 4 mA. Set MEAS/OFF switch to OFF when moving the pen position from 0 mA to 4 mA.

Type KC

(12) Log unit: Type KL

MEAS/OFF (The same as that of Type L)

POSITION

This knob is for pen position adjustment. The pen can be set anywhere within ±10% of the full scale when MEAS/OFF switch is in "OFF" position.

RANGE

Four ranges are provided: 0.5, 5, 50 and 500V as maximum input voltages. The input attenuator of this knob is designed for 60-dB compression (1:1000), the 0.5-V range, for instance, if from 0.5mV (zero point of the scale) to 0.5V. The other ranges, too, are in the same ratio.

AC/DC

This switch is to be left in "AC" or "DC" position to suit the condition of input signal.

* In the absence of input signal, moving MEAS/OFF switch to "MEAS" side deflects the pen all the way to the left: this is because the 0-volt point on the scale is at its left end which signifies infinity.
* In the recording paper, one division of scale graduation corresponds to 0.6 dB.

Type KL

(13) F-V unit: Type KF

MEAS/OFF (The same as that of Type L)

POSITION

For adjustment of pen position. The pen can be positioned anywhere on the full scale when the input signal is off. Normally, the pen is located at the left end.

RANGE

This knob is for selecting the full-scale frequency. A total of 9 ranges, 20 Hz up to 10 kHz, are provided for selection.

Type KF

(14) AC-DC unit: Type KD

MEAS/OFF (The same as that of Type L)

POSITION (The same as that of Type KF)

RANGE

This selector knob is for changing the setting of an input attenuator inside, and provides a total of 8 ranges, 0.01 being the lowest and 2 being the highest.

x1/x100

This two-position switch is for selecting between two multiplying facotrs, 1 and 100, for range voltages. With this switch in "x100" position, the "2" ("3" for the KD-3) range extends to 200 volts (300 volts for the KD-3) to full scale, for example. With RANGE knob and this switch, a total of 16 ranges are available for selective use.

Type KD

10. TURNING ON POWER SUPPLY

(1) Preparatory steps

1) Move MEAS/OFF switches of all amplifier units to "OFF" side.

Fig. 14

2) Set START-STOP switch to STOP position.

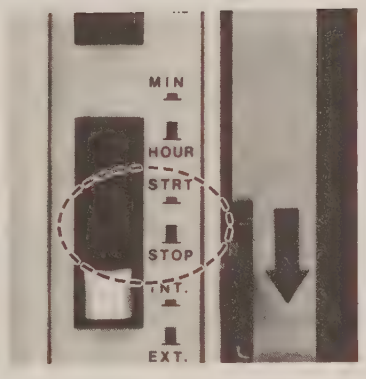


Fig. 15

3) Plug the power supply cord into the receptacle in the back of the recorder.

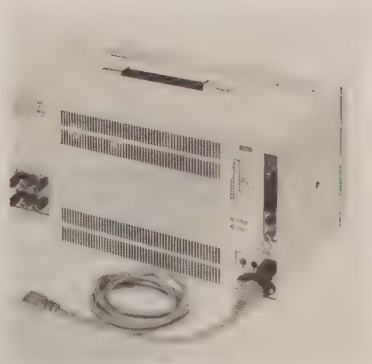


Fig. 16

4) Be sure that POWER switch is off, and plug the power supply cord the supply line out.

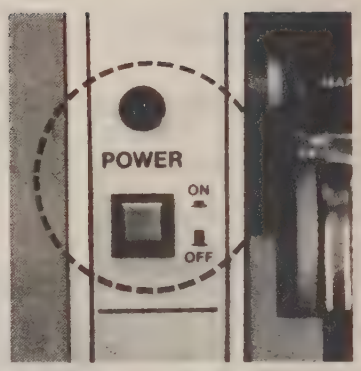


Fig. 17

(2) Turning on power supply

Press POWER switch button: this will light up the pilot lamp and, at the same time, the pen will move to the position corresponding to the zero point set in the amplifier unit.

11. PEN MOUNTING

Remove the paper transport frame, and mount the pens in the following manner:

(1) Remove cap from pen.

(2) Raise pen lifting lever and pen lid. Turn on power supply and, by turning the POSITION knob of the amplifier unit, move each pen arm to one side, as shown in Fig. 19.

(3) Bring pen arm back to the middle, and mount fiber pen on the arm as detailed in Fig. 18. Repeat this process to mount all pens, one channel at a time, starting with Channel 1 (farthest).

(4) For each pen, select the color of the ink matching the color indication on the amplifier unit.

Pen colors assigned to Channels

Channel No.	Color	Amp. unit position	Pen arm position
1	RED	Top	
2	BLACK	Bottom	

Fiber pen replacement

1. Remove paper transport frame and turn up and over graduated scale plate.
2. Turn on power supply.
3. Rotate POSITION knob of amplifier unit to relocate pen arm for convenient position.

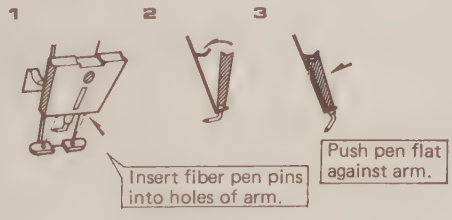


Fig 18

NOTES: The fiber pens are expendable and must be replaced when they have reached the end of useful life. Extend the pen life by adhering to these tips:

- Avoid shocks and excessive pressure to the pen nib or the pen will deform to scribed poorly.
- Do not leave the pens resting on the paper when they are not working: raise each pen off paper to economize the ink.
- When the multicorder is placed in storage or is to be shipped, have the pens removed from the arms and protect them by putting caps on. (Place the removed pens in the utility pocket provided in the rear section of the multicorder case.)

(5) To remove the pen from the arm, give a small pull to its top part, disengaging it from the hold-down spring, and pick it off the arm.

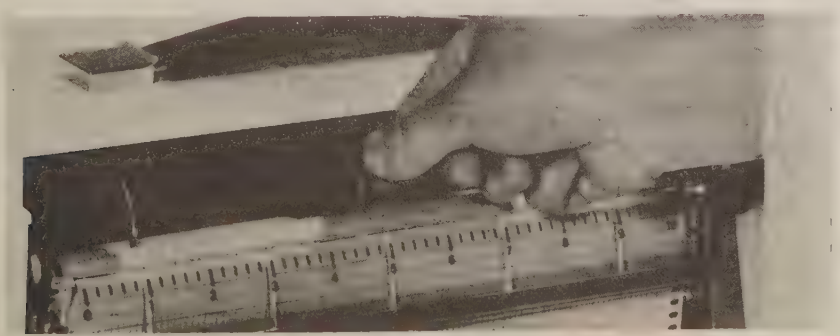


Fig. 19

12. RECORDING PAPER LOADING

(1) Folded paper loading

1) Turn down the left lever below the paper feed unit to unlock it.
2) Turn up the paper feed unit, as shown in Fig. 20, to horizontal position.
3) Pull the paper feed unit out in level direction.
4) Set the folded recording paper in the paper feed unit. See Fig. 22.
5) Pass the leading end of paper around and over the drum, admitting sprockets into the feed holes of paper.
6) Insert the loaded paper feed unit and lock it in place See Fig. 21.

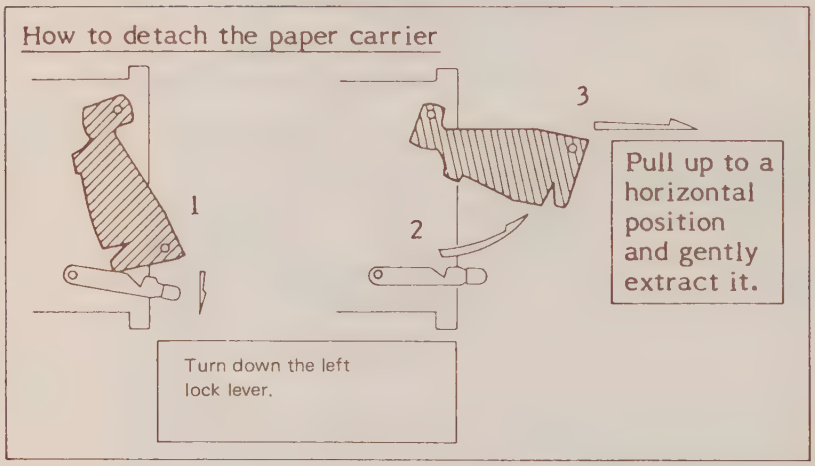


Fig. 20

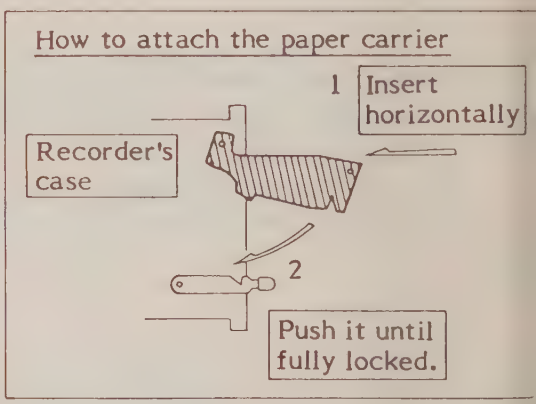


Fig. 21

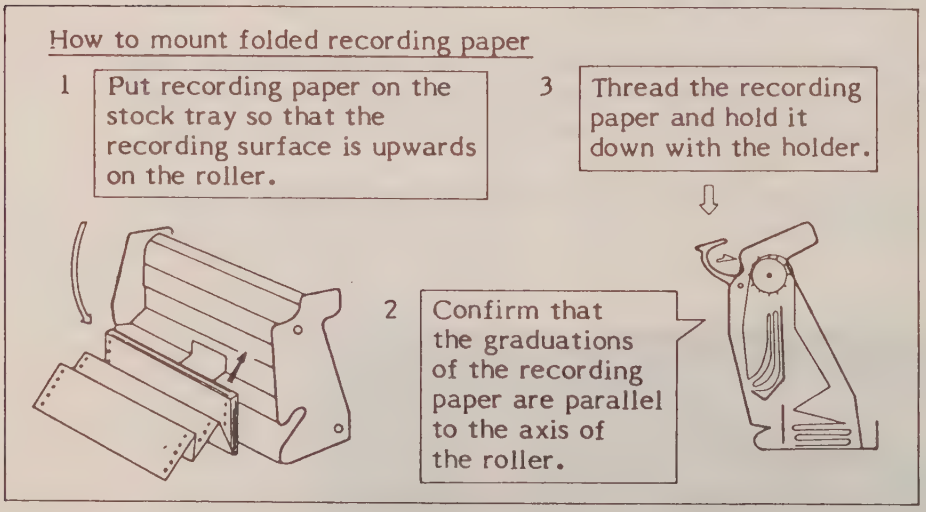

How to mount folded recording paper
1
Put recording paper on the stock tray so that the recording surface is upwards on the roller.
2
Confirm that the graduations of the recording paper are parallel to the axis of the roller.
3
Thread the recording paper and hold it down with the holder.

Fig. 22

(2) Roll paper (optional) loading

1) Turn down the lock lever, to unlock the paper feed unit, as shown in Fig. 20.
2) Turn up the paper feed unit and take it off by pulling it out in level direction.
3) Draw out the stock roller.
4) Give a pull to the two ends of the stock roller to draw off its gear end.
5) Mount the roll paper on the stock roller: be sure to tell the right side of the roll from its left side, so that, when the paper is extended out, its recording face will come on top. Set the loaded stock roller in the paper feed unit. See Fig. 23.
6) Pass the leading end of paper over and around the drum, admitting sprockets into the feed holes.
7) Extend the leading end of paper under and around the guide roller in the lower section of the feed unit, and insert it into the slit of the take-up roller.
8) Tuck in the leading end of paper and rotate the stock roller to make the paper taut.
9) Install the loaded paper feed unit by reversing the sequence of removing steps. Fig. 21

* After taking up the full length of recording paper, remove the paper from the teke-up roller by separating its gear end from the roller part.
* When mounting the stock roller and take-up roller, be sure to discriminate their left ends from right ends.
* Recording operation can be carried out without using the take-up roller: the paper may be paid out to the front of the recorder.
* A recording paper set seal is provided in the paper feed unit: make reference to the seal as need be.

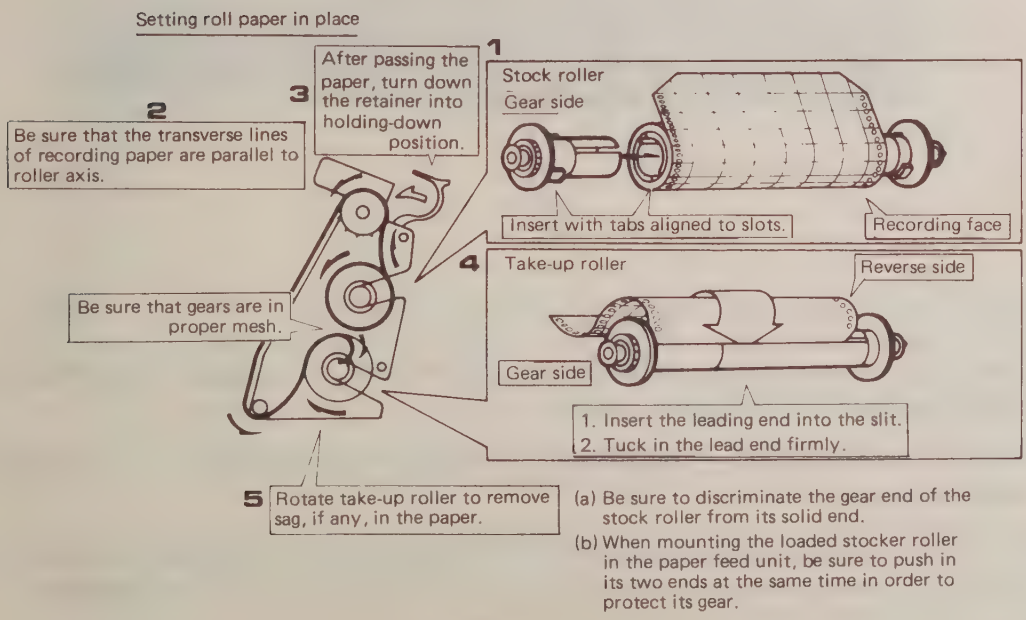

Setting roll paper in place
1
Stock roller
Gear side
Insert with tabs aligned to slots.
Recording face
2
Be sure that the transverse lines of recording paper are parallel to roller axis.
3
After passing the paper, turn down the retainer into holding-down position.
4
Take-up roller
Reverse side
Gear side
1. Insert the leading end into the slit.
2. Tuck in the lead end firmly.
Be sure that gears are in proper mesh.
5
Rotate take-up roller to remove sag, if any, in the paper.
(a) Be sure to discriminate the gear end of the stock roller from its solid end.
(b) When mounting the loaded stocker roller in the paper feed unit, be sure to push in its two ends at the same time in order to protect its gear.

Fig. 23

13. CARE OF RECORDING PAPER

Important tips for handling the recording paper are given at the onset. The tips will be repeated here in addition to two items:

(1) The recording paper in the receiving tray can be wound back to an extent of about 2 meters in length. In other words, paper rewinding is limited. This is because, when the paper is wound back, the rewound portion accumulates in the paper transport frame temporarily without settling down in the stocker tray.

(2) The last portion of the recording paper, about 1 meter long, carries the end mark, shown in Fig. 24. When this mark shows up during operation, steps must be taken immediately to prepare a new stack of recording paper.

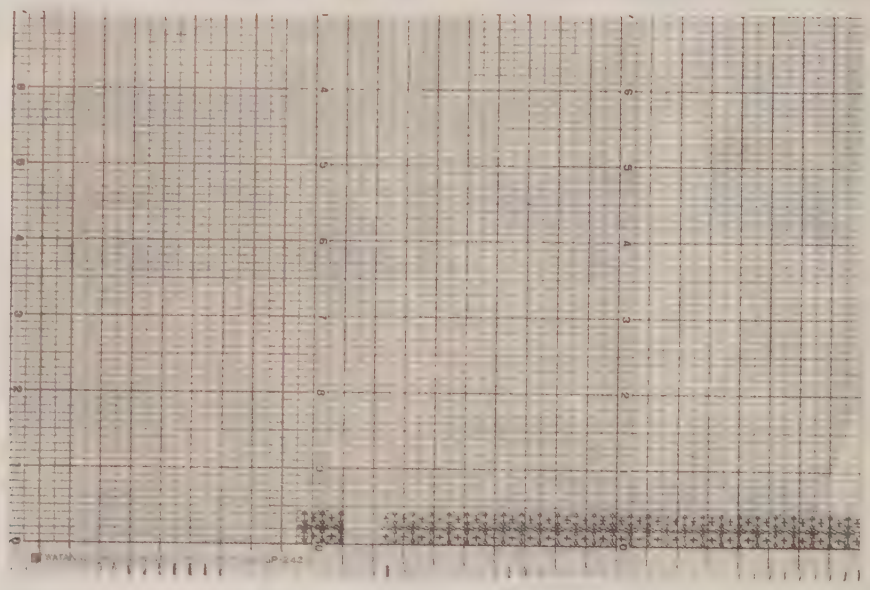


Fig. 24

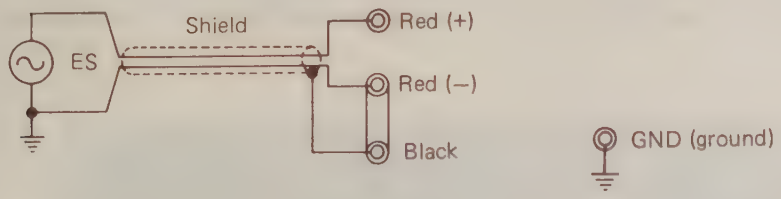
- Under high humidity condition, the self-folding property of the paper might deteriorate. Avoid relative humidity exceeding 85%.
- Re-use of recorded paper is not recommendable because the paper may not fold accurately in second recording.
- Bear in mind that the paper being recorded on might emerge in moistened condition if it is receiving high-density recording. Moistened paper tends to be poor in self-folding action.

14. INPUT SIGNAL CONNECTION

Installing the input cord

○ **Input cord grounded at signal source side**

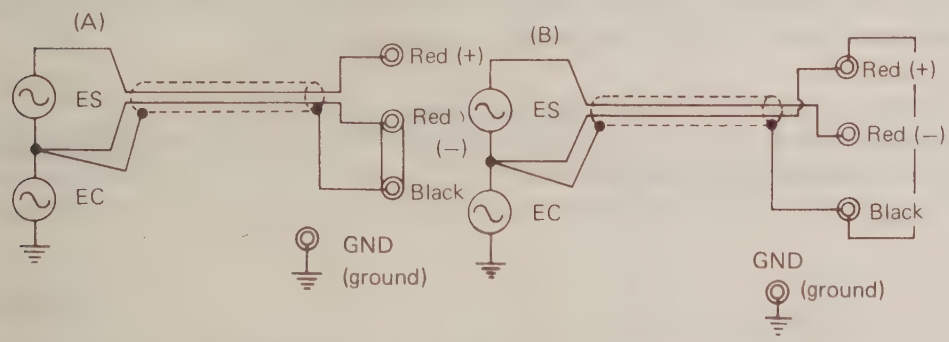
The method of tying this cord into the recorder is as shown here: use a shunt plate to connect red (–) terminal to black terminal, and connect the signal conductor wires to red (+) and red (–) terminals.



CAUTION: The maximum permissible input voltage is 500 volts DC. The signal voltage (ES) must be within this limit and not exceed 100 times the range value.

○ **Input cord with floating ground at signal source**

The method of connection is as shown here: remove the shunt plate between red (–) terminal and black terminal, connect the signal conductor wires to red (–) and red (+) terminals, and connect black terminal to one side of the signal source through the shield.



CAUTION: (1) With the signal source in floating state with respect to ground, a problem occurs in that, at the signal source, the voltage (EC) between input terminal and ground is in phase with the signal voltage. It should be borne in mind that, if EC is an AC voltage, the measuring accuracy of this recorder is high enough for practical purposes for EC of up to 10 volts (peak to peak) where EC is AC signal and up to 100 V where EC is DC signal.

(2) The maximum permissible input voltage is 500 volts DC. The signal voltage (ES) must be within this limit.

(3) The sum of signal voltage (ES) and floating voltage (EC) must not exceed 500 volts DC for the reason that the maximum permissible in-phase voltage is 500 volts DC.

$$EC + ES \leq 500\ V\ (DC)$$

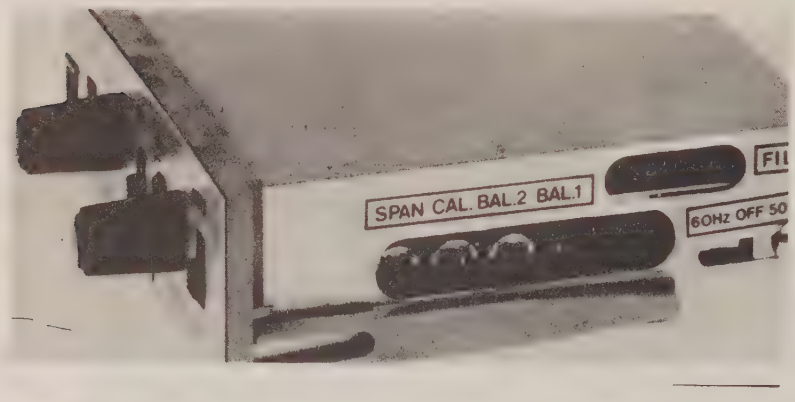
○ **Tips on measuring operation**

(1) Abnormal condition due to noise voltage

○ Signal containing hum (noise due to line frequency)

Excessive hum is likely to displace the pen from its normal position and to deteriorate resolution. The remedy for this condition is to check and correct signal connections and cord shielding at the signal source.

Type H and type Z preamplifiers are shipped from the factory with a built-in noise filter: this filter will be found in "OFF" position. If the hum is intolerably large, cut in the filter by moving its switch to "50 Hz" position, depending on the line frequency.



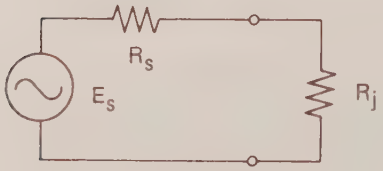
Preamplifier unit

○ High-frequency noise and spike noise

If the pen behaves abnormally, exhibiting erratic motion, it is likely that the recorder is used in the vicinity of a high-frequency or spike noise source.

(2) Error in measurement due to resistance in signal source

The error due to this cause is negligible if resistance in the signal source is much smaller than the input resistance of this recorder.



where E_S = signal voltage
R_S = signal source resistance
R_j = input resistance

$$\text{Measuring error} = E_S \left(1 - \frac{R_j}{R_S + R_j}\right)$$

15. OPERATING PROCEDURE

No. 1 procedure

Preparatory steps

(1) Set the recording chart paper in place.

(2) Plug in the input cord.

(3) Be sure that the input signal selector switch is in "OFF".

(4) Turn RANGE knob to "1000" (Type L) or "500" (Types H and Z).

(5) Plug in the power supply cord.

(6) Turn on POWER switch.

(7) Start running the paper with the desired speed.

(8) Get down PEN LIFT knob.

(9) Move CONT knob to the position for recording density.

General measuring operation Types L, H, Z and E

(1) By using POSITION switch, set the starting point (zero point) of the pen.

(2) Press CAL.V switch, and turn VERNI knob to the position for the desired amplitude.
   a) With VERNI knob turned all the way clockwise, full-scale amplitude will be obtained when an input signal of the RANGE value comes in. For this reason, amplitude adjustment by means of CAL.V is not required if VERNI knob is so set.
   b) The amount by which the pen will deflect upon pressing CAL.V switch corresponds to 1/2 of the RANGE value (±0.3% accuracy). Turning RANGE knob to other positions will not alter that amplitude and, in this case, the amplitude can be changed only by means of VERNI knob.

(3) Move MEAS.OFF switch to "MEAS" position.

(4) Select the speed by means of CHART SPEED switch.

(5) Select the sensitivity to obtain an amplitude suitable for the selected range, and operate the recorder with that amplitude for recording measurement data.

No. 2 procedure

How to use ZERO BIAS Type Z

ZERO BIAS is used to record in expanded pattern when the input signal comes in as superimposed on DC component.

(1) Press CAL switch and adjust amplitude by VERNI.
   NOTE: Turning VERNI knob all the way clockwise results in a sensitivity value equal to the RANGE value.

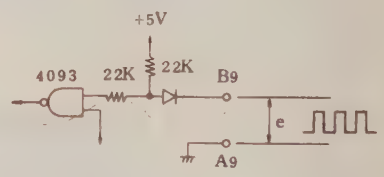
(2) Establish a bias voltage within the range between −300% and +300% of full scale by using BIAS to bring the pen into the effective recording space. Select such a sensitivity as will produce the amplitude that is suited to the selected range, and carry on data recording under this condition.

No. 3 Procedure

How to use remote connector

By feeding clock pulses from an external source through the remote connector, the recording paper can be transported at a speed in step with the pulses, irrespective of the speed setting made at the control panel.

- Move INT/EXT switch to "EXT" position.
- Connect the remote control line to the connector to apply the pulse coltage "e" across (A9) and (B9) of the connector.
- Pulse voltage "e" is prescribe to be:
  1) +3V ~ +8V in amplitude
  2) Not to exceed 400 Hz in frequency
  3) 50 microseconds minimum in pulse width
- Chart paper feed:
  0.05 mm/pulse



No. 4 Procedure

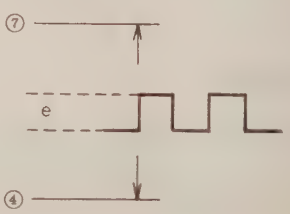
The connector numbers on the main recorder unit are changed when any of the options F-205, F-206 and F-219 is incorporated.

How to use the remote connector

By feeding clock pulses from an external source through the remote connector, the recording paper can be fed on by the pulses, irrespective of the speed setting made at the control panel.

(1) Move INT/EXT switch to EXT.
(2) Connect the remote control line to the connector to apply the pulse "e" across pins (4) and (7) of the connector.

Notes: (1) Pulse "e" has the following specifications:
- Voltage: +3V ~ +5V
- Frequency: 0 ~ 400 Hz
- Pulse width: 50 μs or more



(2) Input (EXT) resistance:
R_1 = 10 K

(3) Chart paper feed: 0.05 mm/pulse

*Rewinding of the recorder paper is done at the speed of the external signal.

16. OPTIONS

○ **Recording paper feed speed (F-203E)**

20, 50, 100, 200, 500 mm/min & hour. EXT (0.05 mm/pulse)

○ **Paper feed unit for both roll paper (SP216B) and Z-fold (SP242) paper (E-215)**

○ **Remote start-stop control of paper feed (F-209)**

- Remote control by external contact closure
  Connect a remote on-off switch to pins (A6) and (B6) of the remote connector. Closing the switch (to short circuit one pin to another) stops the paper being fed.

- Remote control by open collector signal
  When the voltage across pins (A6) and (B6) of the remote collector becomes zero, the recording paper stops.
  (B6) : Collector of transistor
  (A6) : Emitter of transistor

- Remote control by external TTL signal
  When the voltage across pins (A7) and (B7) of the remote connector becomes 5 V, the recording paper stops.
  (B7) : +5V
  (A7) : 0 V

○ **Rack mounting bracket**

- For JIS (DIN) dimension rack (E-212A)
- For inch dimension rack (E-212B)

The appearance of the main plotter unti when incorporating any of the options F-205, F-206, or F-219 is as shown in EXTERNAL APPEARANCE/DIMENSIONS B. The connector numbers for F-209 will change as below at the same time (when any of the above options is used).

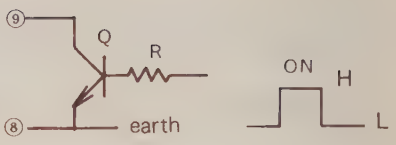
○ **Event marker (F-205)**

- Remote controlled by an external TTL signal or contact closure.
- Event marking to be made in the space at right-hand edge of recording paper.
- Recording with a fiber pen in black.
- Recording action in one-shot marking, approx. 0.2 sec shots.
- Recording amplitude : approx. 1.5 mm
- Repeating action time : 0.5 sec. min.
- Contact capacity for the external control switch to be 10 mA, DC 10 volts.

(1) Remote control by an external contact closure
Closing a simple switch shorts pin(8) and (9) causes event marker to perform one cycle of marking operation.

(2) Remote control by an open collector signal
0 volt between pin(8) and (9) of remote collector (Transistor switched ON) causes event marker to perform one cycle of marking operation.

(9) : Open collector (Collector of transistor)
(8) : 0 volt (ground)



○ **Time marker (F-206)**

- Marking action is in step with speed of chart paper transport; it is automatically started and ended.
- Marking to be made on the marker space at the left-hand edge of recording paper.
- Recording with a fiber pen in red.

Timing

Timing	Chart speed
1 SEC	1200, 600 mm/MIN
10 SEC	300, 150, 120, 75, 60 mm/MIN
1 MIN	30, 15 mm/MIN, 1200, 600 mm/HOUR
10 MIN	7.5 mm/MIN, 300, 150, 120, 75, 60, 30, 15, 7.5 mm/HOUR

The time marker generates double pulses to make reading easy. The double pulses are generated at the following intervals:

- When timing is 1 SEC, a double pulse every 10 second.
- When timing is 10 SEC, a double pulse every 1 minute.
- When timing is 1 MIN, a double pulse every 10 minutes.
- When timing is 10 MIN, a double pulse every 1 hour.

○ **Remote start-stop control of paper transport (F-209)**

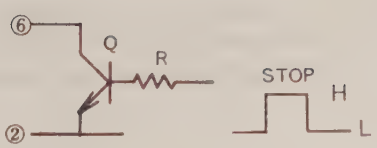
- Remote controlled by an external TTL signal or contact closure.
- Contact capacity for the external control switch to be 10 mA, DC 10 volts.

* Remote control should be made after setting of CHART REMOTE/MANUAL switch to REMOTE position.

(1) Remote control by an external contact closure
Connect a remote on-off switch to pin(6) and (2) of remote connector. Closing the switch (to short-circuit one pin to other) stops the paper being transported.

(2) Remote control by an open collector signal.
0 volt between pin(6) and (2) of remote collector (transistor switched ON) causes recording paper to stop running.

(6) : Open-collector (collector of transistor)
(2) : 0 volt (ground)



(3) Remote control by TTL signal
When the voltage across pins (2) and (5) of the remote connector becomes 5 V, the recording paper stops.

(5) : +5V (TTL input)
(2) : 0V (ground)

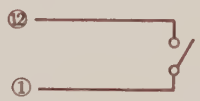
○ **Pen up/down remote control (F-219A)**

○ Remote controlled by an external contact closure, open collector signal or TTL signal.

* Remote control should be operated after pens being lifted by means of pen lift lever.
* Contact of remote control should be used independent one and not be used as common with the other remote control contacts.
* Recorder should be operated, putting horizontally.

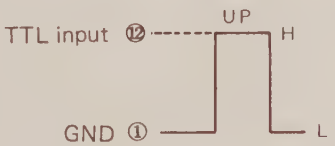
○ **Pen up/down remote control (F-219A)**

(1) Remote control by an external contact closure.
Closing a simple switch shorts pin(1) and (12) causes recording pen to perform getting down.



(2) Remote control by an external TTL signal.
5 volts between pin(2) and (12) of remote connector causes recording pen to perform getting up.

(12) : +5V (TTL input)
(1) : 0 volt (ground)



(3) Remote control by open-collector signal.
0 volt between pin(1) and (12) of remote connector causes recording pen to perform getting down.

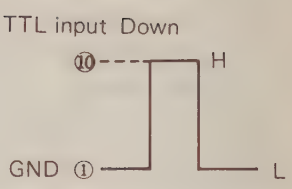
(12) : Open-collector (Connector of transistor)
(1) : 0 volt (ground)

○ **Pen up/down remote control (F-219B)**

(1) Remote control by an external TTL signal 5 volts between pin(1) and (10) of remote connector causes recording pen to perform getting down.

(10) : +5V (TTL input)

(1) : 0 volt (ground)



○ **Rack mounting brackets**

For JIS dimension rack (D-212A)

For inch dimension rack (D-212B)

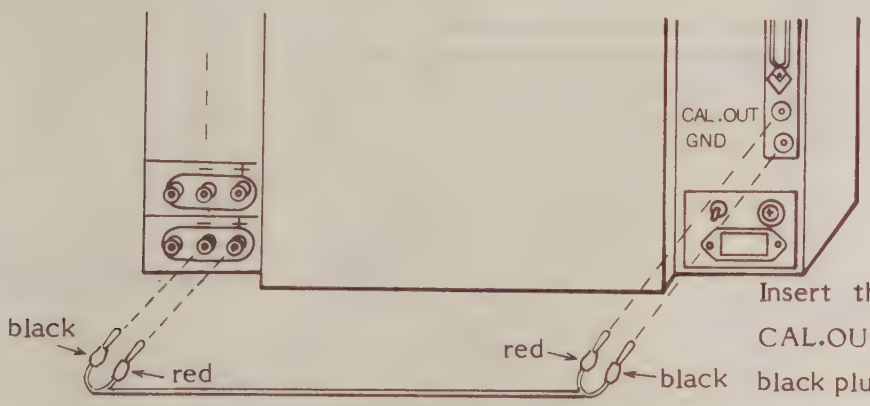
17. CALIBRATION TERMINALS

When an amplifier unit is replaced, the accuracy will be ±1%. To achieve a better accuracy, make adjustments by means of the calibration terminals on the rear panel of recorder (only L, H and Z types amplifiers can be adjusted).

1. How to use calibration terminals

(1) Connection

Connect the calibration signal cord provided as shown below.



Insert the red plug in the CAL.OUT socket and the black plug in the GND socket

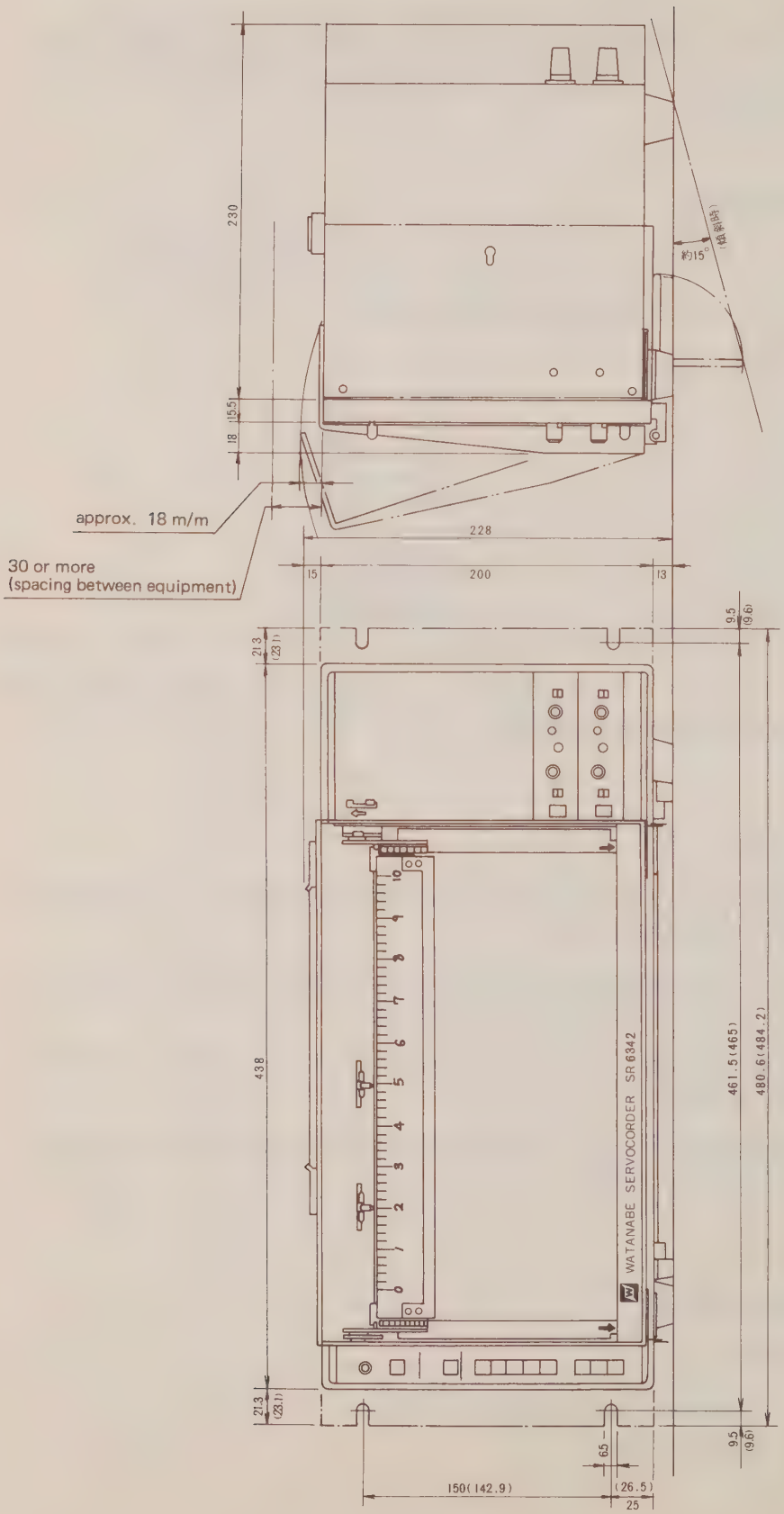
(2) Method of adjustment

1. Set the sensitivity of the preamplifier of channel to be calibrated to 1 V and turn the VERNIER knob fully to the right.
2. Short-circuit the input terminals and move pen to the base line on the left side of recording paper by turning the POSITION VR knob.
3. Insert the calibration cord into the input terminals and the calibration terminals (refer to the figure above).
4. Adjust the deflection of the pen to 250 mm by turning the SPAN VR through the hole on the side of the recorder.

2. Specification of calibration output

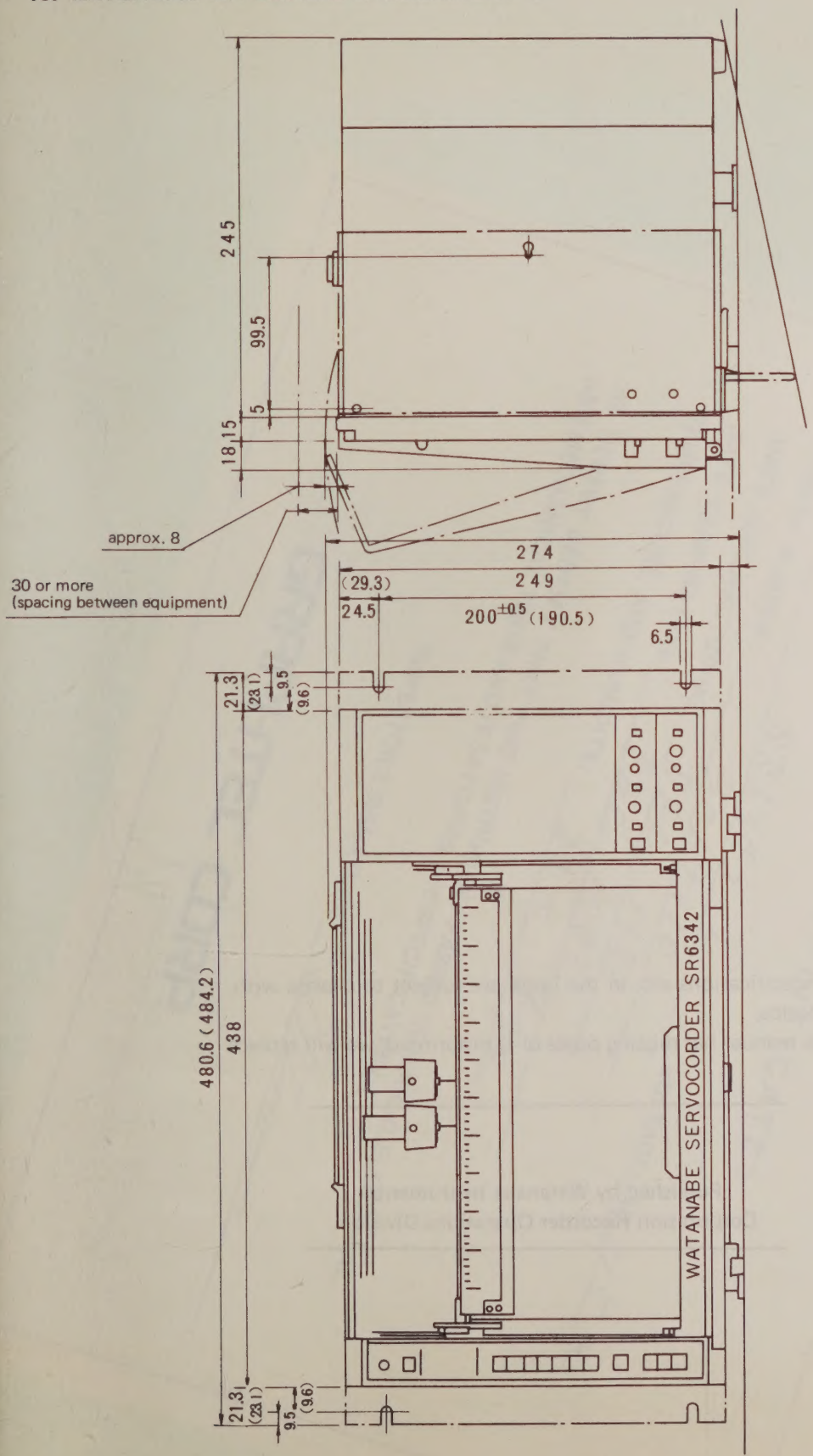
- Calibrating signal output : 1 V DC
- Accuracy : ±0.08% (over 90 days at 20° C ±5° C)
- Output resistance : 200Ω or less

18. EXTERNAL APPEARANCE/DIMENSIONS A

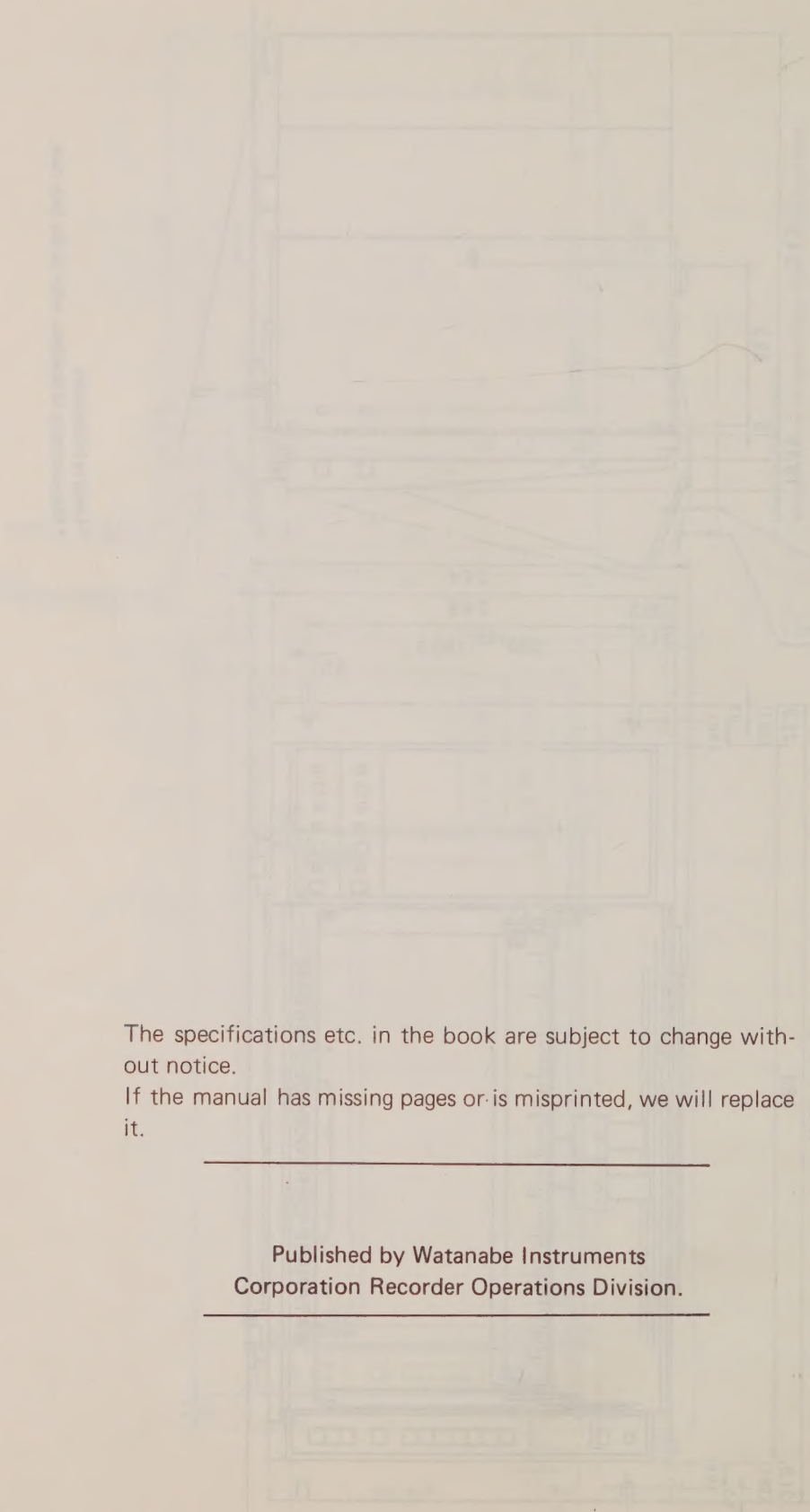


* Units in millimeters
* Measurements in parentheses refer to the Inch rack.

19. EXTERNAL APPEARANCE/DIMENSIONS B



* Units in millimeters
* Measurements in brackets, refer to the Inch rack.



The specifications etc. in the book are subject to change without notice.
If the manual has missing pages or is misprinted, we will replace it.

Published by Watanabe Instruments
Corporation Recorder Operations Division.

≪TEST CERTIFICATE≫

MODEL: SR6342-L VOLTAGE: AC 115 V

SERIAL NUMBER: 3019110

DATE MANUFACTURING: DEC, 1983

DATE EXAMINATION: DEC, 1983

TEMPERATURE AND HUMIDITY: 23 °C 57 %

WE HEREBY CERTIFY THAT THIS INSTRUMENT PASSED OUR RIGID ELECTRICAL AND MECHANICAL TESTS AND IT SATISFIES THE SPECIFICATION.

INSPECTOR'S SIGNATURE

GRAPHTEC CORP.

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